

COURSE SYLLABUS

Academic year 2024-2025

1. Programme Information

1.1. Higher education institution	Lucian Blaga University of Sibiu
1.2. Faculty	Faculty of Engineering
1.3. Department	Department of Computer Science and Electrical and Electronics Engineering
1.4. Field of study	Computer Science and Information Technology
1.5. Level of study ¹	Master
1.6. Programme of study/qualification	EMBEDDED SYSTEMS

2. Course Information

2.1. Name of course	Plant Control	Code	ES.304.ZA
2.2. Course coordinator	Prof. Bălă Constantin ZAMFIRESCU, PhD		
2.3. Seminar/laboratory coordinator	Prof. Vasile CRĂCIUNEAN, PhD		
2.4. Year of study ²	2	2.5. Semester ³	3
		2.6. Evaluation form ⁴	E
2.7. Course type ⁵	A	2.8. The formative category of the course ⁶	Z

3. Estimated Total Time

3.1. Course Extension within the Curriculum – Number of Hours per Week					
3.1.a. Lecture	3.1.b. Seminar	3.1.c. Laboratory	3.1.d. Project	3.1.e. Other	Total
2		2			4
3.2. Course Extension within the Curriculum – Total Number of Hours within the Curriculum					
3.2.a. Lecture	3.2.b. Seminar	3.2.c. Laboratory	3.2.d. Project	3.2.e. Other	Total ⁷
28		28			56
Time Distribution for Individual Study ⁸					Hours
Learning by using course materials, references and personal notes					12
Additional learning by using library facilities, electronic databases and on-site information					12
Preparing seminars / laboratories, homework, portfolios and essays					56
Tutorial activities ⁹					10
Exams ¹⁰					4
3.3. Total Individual Study Hours ¹¹ (NOSI _{sem})					94
3.4. Total Hours in the Curriculum (NOAD _{sem})					56
3.5. Total Hours per Semester ¹² (NOAD _{sem} + NOSI _{sem})					150
3.6. No. of Hours / ECTS					25
3.7. Number of credits ¹³					6

4. Prerequisites (if needed)

4.1. Courses that must be successfully completed first (from the curriculum) ¹⁴	Basic courses in informatics (programming, algorithms), software engineering, and artificial intelligence.
4.2. Competencies	

5. Conditions (where applicable)

5.1. For course/lectures ¹⁵	Board, video projector, flipchart, specific teaching materials, online platforms
5.2. For practical activities (lab/sem/pr/app) ¹⁶	Computing technology, software packages, online platforms

6. Specific competencies acquired¹⁷

Number of credits assigned to the discipline ¹⁸			Credits distribution by competencies ¹⁹
6			
6.1. Professional competencies	PC5	perform scientific research	0,5
	PC6	evaluate research activities	1
	PC9	prepare production prototypes	0,5
	PC12	promote the transfer of knowledge	1
	PC13	perform data analysis	0,5
	PC15	apply statistical analysis techniques	0,5
6.2. Transversal competencies	TC1	apply knowledge of science, technology and engineering	1
	TC2	show initiative	0,5
	TC3	assume responsibility	0,5

7. Course objectives (resulted from developed competencies)

7.1. Main course objective	<ul style="list-style-type: none"> The course will address from the engineering perspective the advanced application and implementation issues of formal control systems - such as inventory control, manufacturing planning, operations scheduling. Topics will include the state of the art methodologies to engineer agent-based intelligent manufacturing systems.
7.2. Specific course objectives	<ul style="list-style-type: none"> Understanding what a complex system is, and engineering methods to master its complexity Working with Interaction protocols Employing advanced software engineering abstractions

8. Content

8.1. Lectures ²⁰		Teaching methods ²¹	Hours
Lecture 1	The pyramid of automation: basic concepts in manufacturing control systems	Exposition, lecture, use of video projector, discussions with students	2
Lecture 2	The pyramid of automation: basic concepts in manufacturing control systems (cont.)	Exposition, lecture, use of video projector, discussions with students	2
Lecture 3	Engineering approaches: centralized vs. decentralized, object-oriented vs. agent-oriented	Exposition, lecture, use of video projector, discussions with students	2
Lecture 4	Agent-based manufacturing systems	Exposition, lecture, use of video projector, discussions with students	2



Lecture 5	Agent-based technology: basic concepts of agenthood	Exposition, lecture, use of video projector, discussions with students	2
Lecture 6	Agent architectures: reactive, deliberative, pragmatic	Exposition, lecture, use of video projector, discussions with students	2
Lecture 7	Agent architectures: reactive, deliberative, pragmatic (cont.)	Exposition, lecture, use of video projector, discussions with students	2
Lecture 8	Multi-agent coordination mechanisms	Exposition, lecture, use of video projector, discussions with students	2
Lecture 9	Engineering methodologies of multi-agent systems	Exposition, lecture, use of video projector, discussions with students	2
Lecture 10	Intelligent manufacturing systems: basic concepts and relevant approaches	Exposition, lecture, use of video projector, discussions with students	2
Lecture 11	Agent-oriented approaches to plant control: PROSA - the reference architecture.	Exposition, lecture, use of video projector, discussions with students	2
Lecture 12	Holonic manufacturing systems: PROSA, ARTI - coordination issues.	Exposition, lecture, use of video projector, discussions with students	2
Lecture 13	Industrial cases of intelligent manufacturing control systems	Exposition, lecture, use of video projector, discussions with students	2
Lecture 14	Relevant research projects and initiatives	Exposition, lecture, use of video projector, discussions with students	2
Total lecture hours:			28



8.2. Practical activities (8.2.a. Seminar ²² / 8.2.b. Laboratory ²³ / 8.2.c. Project ²⁴)		Teaching methods	Hours
Act.1	The FESTO flexible production line	Practical demonstration, exercise	2
Act.2	Programming the sensors and actuators	Practical demonstration, exercise	2
Act.3	PLC programming	Practical demonstration, exercise	4
Act.4	Workstation programming (synchronization and real time control of the available set of sensor and actuators)	Practical demonstration, exercise	8
Act.5	Workflow programming (synchronization and dispatching of manufacturing operations among the available workstation)	Practical demonstration, exercise	8
Total seminar/laboratory hours:			28

9. Bibliography

9.1. Recommended Bibliography	Stephen N. Chapman (2006). Fundamentals of Production Planning and Control. Prentice Hall.
	Michael Wooldridge (2009). An Introduction to Multi-Agent Systems - Second Edition, John Wiley & Sons
	Smart Factory: http://www.smartfactory-kl.de/
	Intelligent Manufacturing Systems (2010). IMS Program: http://www.ims.org/
	Siemens AG (2007). Working with STEP 7.
	Paulo Leitão, Stamatios Karnouskos (2015). Industrial Agents: Emerging Applications of Software Agents in Industry. Elsevier
9.2. Additional Bibliography	Elsevier Journal of Engineering Applications of Artificial Intelligence
	Elsevier Journal of IFAC Annual Reviews in Control
	Brian Henderson-Sellers, Paolo Giorgini (2005). Agent-oriented methodologies, Idea Group.

10. Conjunction of the discipline's content with the expectations of the epistemic community, professional associations and significant employers of the specific study program²⁵

Students will acquire research skills preparing them for the transition to a new stage of doctoral admission. It is carried out through regular discussions in a formal and informal setting with the representatives of the profile companies.

11. Evaluation

Activity Type	11.1 Evaluation Criteria	11.2 Evaluation Methods		11.3 Percentage in the Final Grade	Obs. ²⁶
11.4a Exam / Colloquy		Tests during the semester ²⁷ :	10%	60%	CPE



	• Theoretical and practical knowledge acquired (quantity, correctness, accuracy)	Homework:	20%		
		Other activities ²⁸ :	10%		
		Final evaluation:	60%		
11.4c Laboratory	• Knowledge of the equipment, how to use specific tools; evaluation of tools, processing and interpretation of results	• Written questionnaire • Oral response • Laboratory notebook, experimental works, reports, etc. • Practical demonstration	40%		CPE
11.5 Minimum performance standard²⁹ The final assessment will include written work consisting of (partial) grid tests and problems. <ul style="list-style-type: none"> • Knowledge, understanding and explaining the basics of evolutionary computing. • Constant interest to acquire discipline. • Partial fulfilment (50%) of homework, essays and tests given during the semester. 					

The Course Syllabus will encompass components adapted to persons with special educational needs (SEN – people with disabilities and people with high potential), depending on their type and degree, at the level of all curricular elements (skills, objectives, contents, teaching methods, alternative assessment), in order to ensure fair opportunities in the academic training of all students, paying close attention to individual learning needs.

Filling Date: 13.09.2024
Department Acceptance Date: 16.09.2024

	Academic Rank, Title, First Name, Last Name	Signature
Course Teacher	Prof. Bălă Constantin ZAMFIRESCU, PhD	
Study Program Coordinator	Prof. Arpad GELLERT, PhD	
Head of Department	Assoc. Prof. Radu George CREȚULESCU, PhD	
Dean	Prof. Maria VINȚAN, PhD	



¹ Bachelor / Master

² 1-4 for bachelor, 1-2 for master

³ 1-8 for bachelor, 1-3 for master

⁴ Exam, colloquium or VP A/R - from the curriculum

⁵ Course type: R = Compulsory course; E = Elective course; O = Optional course

⁶ Formative category: S = Specialty; F = Fundamental; C = Complementary; I = Fully assisted; P = Partially assisted; N = Unassisted

⁷ Equal to 14 weeks x number of hours from point 3.1 (similar to 3.2.a.b.c.)

⁸ The following lines refer to individual study; the total is completed at point 3.37.

⁹ Between 7 and 14 hours

¹⁰ Between 2 and 6 hours

¹¹ The sum of the values from the previous lines, which refer to individual study.

¹² The sum (3.5.) between the number of hours of direct teaching activity (NOAD) and the number of hours of individual study (NOSI) must be equal to the number of credits assigned to the discipline (point 3.7) x no. hours per credit (3.6.)

¹³ The credit number is computed according to the following formula, being rounded to whole neighbouring values (either by subtraction or addition)

$$\text{No. credits} = \frac{\text{NOCpSpD} \times C_C + \text{NOApSpD} \times C_A}{\text{TOCpSdP} \times C_C + \text{TOApSdP} \times C_A} \times 30 \text{ credits}$$

Where:

- NOCpSpD = Number of lecture hours / week / discipline for which the credits are calculated
- NOApSpD = Number of application hours (sem./lab./pro.) / week / discipline for which the credits are calculated
- TOCpSdP = Total number of course hours / week in the Curriculum
- TOApSdP = Total number of application hours (sem./lab./pro.) / week in the Curriculum
- C_C/C_A = Course coefficients / applications calculated according to the table

Coefficients	Course	Applications (S/L/P)
Bachelor	2	1
Master	2,5	1,5
Bachelor - foreign language	2,5	1,25

¹⁴ The courses that should have been previously completed or equivalent will be mentioned

¹⁵ Board, video projector, flipchart, specific teaching materials, online platforms, etc.

¹⁶ Computing technology, software packages, experimental stands, online platforms, etc.

¹⁷ Competences from the Grids related to the description of the study program, adapted to the specifics of the discipline

¹⁸ From the curriculum

¹⁹ The credits allocated to the course are distributed across professional and transversal competences according to the specifics of the discipline

²⁰ Chapter and paragraph titles

²¹ Exposition, lecture, board presentation of the studied topic, use of video projector, discussions with students (for each chapter, if applicable)

²² Discussions, debates, presentations and/or analyses of papers, solving exercises and problems

²³ Practical demonstration, exercise, experiment

²⁴ Case study, demonstration, exercise, error analysis, etc.

²⁵ The relationship with other disciplines, the usefulness of the discipline on the labour market

²⁶ CPE – Conditions Exam Participation; nCPE – Does Not Condition Exam Participation; CEF - Conditions Final Evaluation; N/A – not applicable

²⁷ The number of tests and the weeks in which they will be taken will be specified

²⁸ Scientific circles, professional competitions, etc.

²⁹ The minimum performance standard in the competence grid of the study program is customized to the specifics of the discipline, if applicable